

A NEW APPLICATION OF TAXONOMIC PRINCIPLES.

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Scarcely more than half a century has passed since the belief was generally entertained as indisputable that species and other taxonomic categories were fixed and unchangeable entities. The basic elements of current taxonomy date a century farther back.

Our taxonomic system was founded on the principle of permanency in organic morphology, without any idea of change and evolution. In its original concept and application it was therefore inelastic and not in accord with the facts. We have been constantly endeavoring, however, to apply this inelastic system to the elastic morphology of living matter. The result is a demonstration of incompatibility between the two.

Any taxonomic system must be arbitrary and fixed in certain of its fundamental aspects, but it must also accord with phylogenetic facts. A radically new system is not here proposed, but merely a modification of the current system to fit the phylogenetic facts that we find today. It is not held that living matter is morphologically changing with such rapidity that it needs a system which will change within a lifetime in order to keep up with the progress of evolution. But it is held that living forms exhibit distinct phylogenetic phases according to the age of the stocks of which they form a part, and that this fact must be taken into account in their taxonomic treatment.

No stock is today changing rapidly enough in nature for us to note the specific steps of change. But if we pass all stocks in phylogenetic review we are struck most forcibly with the successive but gradual change of conditions exhibited as we proceed from the oldest to the youngest stocks. In such review we get an instantaneous reflection of the bimorphologic changes which take place in time.

It has fallen to the lot of the writer to make a critical study of the morphology and phylogeny of the muscoid flies, which undoubtedly comprise some of the youngest stocks of insects, and to attempt to establish a taxonomic treatment of them which shall accord with their morphology and phylogeny and

thus prove satisfactory from all practical points of view. In this task difficulties have been encountered which can only be surmounted by conforming to lines of logical simplicity. Phylogenetic facts can not be changed. The logical alternative is to change our pseudophylogenetic plan of taxonomy to a phylogenetic one.

The history of muscoid taxonomy furnishes a vivid illustration of the necessity for such change. The chronologic alternation between splitting and lumping has been constant, but always gradually tending toward greater radicalism in the former. Brauer and Bergenstamm were the first students of the superfamily to recognize the difference in phylogenetic conditions existing here and to put the idea into words. Their system of taxonomy shows that they approached much nearer to the truths of phylogeny than had any former students of the group, but they failed in many cases to grasp the relationships because they had no uniformly true criterion thereto in the external adult anatomy. It has been left for students since their time to discover criteria in the reproductive system and early stages that furnish unmistakable clues to these relationships.

It was the good fortune of the writer to figure largely in the last named investigations, and therefore to obtain facts which constitute a definite basis for phylogenetic deductions. Once such deductions are authoritative—recognized as unmistakably founded on fact—we are able to proceed with confidence in the separation of forms of diverse origin, however similar may be their external morphology. This process brings us face to face with phylogenetic facts that could never before be confidently accepted, and with many which were never before suspected to exist. It compels us to draw lines where such were never before imagined, and it emphasizes with extreme force the shortcomings of current taxonomy if applied to young stocks.

The writer claims in this connection nothing more than a clear view and conscientious record of what has come within his range of vision. The privilege of applying a phylogenetic key to the taxonomy of some of the youngest and most obscurely differentiated groups of insects has been his, and it has furnished him an insight into the relationships of these groups and into the taxonomic needs of young stocks in general that was only

dimly comprehended before. The one who uses this key conscientiously and with fair judgment must get this insight. It only remains to bring the taxonomy into accord with the conditions. This is no simple matter, but it is capable of adjustment.

A careful comparative study of muscoid conditions by the writer, extending over the past five or six years and beginning before the reproductive and early-stage criteria became available has resulted in what may be called the typic-atypic application of taxonomic principles. The idea was dimly comprehended in 1907 from a study of the external adult anatomy alone and published in May, 1908 (*Tax. Musd. Flies*), while a clearer perception of it was gained and the foundation for its practical application laid during the next few months and the results published in September, 1908 (*Rec. Res. from Rear. and Dis. Tach.*). From that time to the present the typic-atypic idea in taxonomy has kept pace with the progress of the investigations into the reproductive and early-stage characters of the muscoid flies as compared with their external adult morphology. The working out of the scheme of application with the view of ultimately bringing it to a point of completeness has been laborious in the extreme, and many mistakes and new starts have been made. Theoretical phylogeny and a taxonomic application to match have been constantly checked up by practical and actual phylogeny, thus showing errors that have had to be corrected.

The writer has been still further fortunate in being able to spend some time during the past three years, 1910 to 1912, in several districts of the Andean montanya in Peru and Ecuador, perhaps the most favored biotic region on earth and thus the best adapted to illustrate the working out of phylogenetic principles in nature. Here he has been tremendously impressed with the extreme richness in transitional forms displayed by certain of the youngest muscoid stocks, which have furnished additional proofs of the soundness of the typic-atypic system of treatment. A paper on these forms is forthcoming (*New Gen. and Spp. Musc. Flies, chiefly Hystriciidæ from the And. Montanya*).

The typic-atypic system calls into use the new group-unit category, which includes the typic genus and such atypic genera as approach more closely to it than to any other typic

genus. It has gradually become evident that this category is a natural prime division of the subtribe, demanded in young stocks where transitional forms are numerous present but not as a rule called for in older stocks where such transitionals are infrequent.

It may be pointed out by way of illustration that we know many insect stocks whose component forms are well differentiated from each other; we know other insect stocks whose forms are less markedly differentiated among themselves, and we know still further stocks which comprise masses of closely similar forms. The first are old stocks, the second are middle-aged stocks practically in their prime; the last are young stocks, still undergoing evolution and characterized by the presence of many transitional forms. The same system of taxonomy is not applicable to all these classes of stocks. The three classes mentioned are of course not clearly delimited, for certain stocks are bound to be intermediate between them. But each stock can always be treated on its own merits. For the first class in general, the current system of taxonomy answers fairly well—that is to say, the tribes are usually quite easily divided directly into genera. In the second class, comprising in general the stocks of middle age, we need the subtribal category between the tribe and the genus. In the youngest stocks we need to employ still another category, as an elementary grouping of genera, between the subtribe and the genus. This is what has been termed the group-unit, for it is both theoretically and practically the unit of taxonomic groups.

So far as it has been possible to work out the status of the group-unit to date, its value appears to correspond to a fractional part of the contracted subtribal value and the whole or a part of the transitional subtribal value, as these values are exhibited in young superfamilies and stocks undergoing evolution. The group-unit therefore corresponds to the well marked genus in the old stocks, plus its intergeneric space which is conceived to be a fixed quantity covering certain transitionals that have dropped out. The well marked genus itself corresponds to the typic genus of the group-unit, while the latter has associated with it various transitional or atypic genera which are not represented in the old stocks but must here be fitted into the taxonomic system. These transitionals or atypic genera are not subgenera of the typic genus. They are subordinated to

the latter only in consensus of characters and not in value. They correspond to the intergeneric space that belongs with the well marked genus in the old stocks, but which forms no integral part of it. The writer has considered well the possibility of interpreting the group-unit, as here constituted, to be the natural genus, and thus of doing away with the necessity for the name group-unit by employing the subgeneric category instead of the generic for the group-unit's prime divisions. This plan has proved not to be practicable. Subgeneric divisions may often be recognized within the typic genus, and sometimes in the atypic genera, so neither can be considered subgenera. In the sum of their characters the typic and atypic genera are too distinct from each other to be considered as mere ill-defined groups of species under a genus embracing all the forms in the group-unit. Genera are prominently distinguishable groups of species, and the atypic as well as the typic genera fit the definition. Furthermore, in the young stocks there are inter-subtribal groups of transitionals which come between the subtribes proper or typic subtribes, and which may be termed transitional or atypic subtribal groups. The group-unit is capable of representing in their true relationships and thus accomodating in the taxonomic system these transitional subtribal forms, which do not occur in the old stocks and can not be fitted into the system of taxonomy commonly applied thereto.

Attention must be drawn to the fact that stocks become fixed, and thus easily amenable to delimitation on the old plan, only when their evolution is completed. The lives of stocks and groups of stocks may well be likened to the lives of individuals. They differ in extending over far greater periods of time, which is only a relative difference. Like individuals, they spring from small and embryonic beginnings, are launched upon the outer world, gradually grow, unfold, develop, pass through various stages of change and specialization, in time reach their zenith and cease evolution, finally wane, become senile and eventually extinct. Waning and senile stocks and all those that have ceased evolution, that is to say fully matured stocks, are easily defined because few or no transitionals are present to hinder definition. But stocks that have not yet reached their zenith, that is to say adolescent stocks, are filled

with transitionals and hence their component categories are difficult of delimitation.

These facts and the consequent necessity for a fractional subtribal category must be apparent to anyone who studies these flies assiduously. In many cases the natural tribes and subtribes can not be defined on the external characters of the adult, nor can they be defined in other than a very complex and thus highly unsatisfactory manner on all characters, due to the presence of the transitionals, and we are thus forced to employ more restricted group categories in order to make a taxonomic system fit them. The conditions which we face here are those that obtain at any given time during the active evolution of new and young stocks. If we had all the individuals that have been produced during the evolution of any subtribe of insects, arranged before us in the order of their descent, we would be totally unable to classify them into either group-units, genera, subgenera or species, simply because no lines of division would be indicated for such separations. They would be found to form a mass of transitionals in a gradual and spreading transition from first to last; through their roots all would be found to connect by gradual transitions with each other. But at any given point in their development by excluding their predecessors, the remnant would be amenable to separation into categories after the group unit plan. These conditions actually obtain in certain young stocks today, and it is only due to the fragmentary nature of the material which we are able to secure out of their totals of countless individuals produced that we are able to attempt a classification of the residue. We do not have to fit their predecessors into the taxonomic system, since they are all lost to us except recent material which agrees with the present. Therefore we are able to draw lines of separation, but the transitionals present demand that the lines be drawn closely. Here lies the necessity for the group-unit category. Its province is to represent the transitional subtribal forms in their true relationships to the typical divisions of the subtribe proper, in young and new stocks now undergoing evolution.

The term group-unit was chosen because the value of the category to which it is applied is bound to be the unit of group values. Species and genera are both taxonomic units, since both enter into the concept and construction of the binomial.

The elemental combinations of genera must thus constitute the units of group formations and values. It is proposed that the name of the group-unit be formed by adding *iae* to the root of the name of its typic genus. This does not conflict with any of the group endings established by the International Code and by general usage.

The group-unit permits us to arrange with phylogenetic fidelity the components of stocks whose transitionals are largely present, fitting all into a natural taxonomic system. There can be not the slightest doubt that this category is an absolute necessity to the clear and concise taxonomic handling of the forms that comprise the youngest stocks. The further details of the new application of taxonomic principles here outlined largely remain to be worked out. This must be done by applying the principles to the young stocks themselves as they exist today.